Southern Ocean Modern Observations/Weddell Sea Moorings

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Project Summary

The world's deep oceans are filled with water masses formed at the continental margins of Antarctica. The Weddell Sea is a major source of these so-called Antarctic Deep and Bottom Waters. Relatively warm, saline Circumpolar Deep Water (CDW) enters the Weddell Gyre to the east of the Greenwich Meridian. As it traverses the gyre, it feeds bottom water-forming processes on the continental shelves, and interacts with floating ice shelves to produce a variety of Weddell Deep and Bottom water types.

This project maintains three deep and bottom water focused moorings south of the South Orkney Islands in the Northwest Weddell Sea to provide a time series of the combined outflow (currents and temperature/salinity) of Antarctic Deep and Bottom Water drawn from various sites within the Weddell Sea. The moorings were initially installed and maintained as part of the NOAA-funded Consortium on Oceans Role in Climate: AbRupt climate CHangE Studies (CORC-ARCHES) Southern Ocean Modern Observations program.

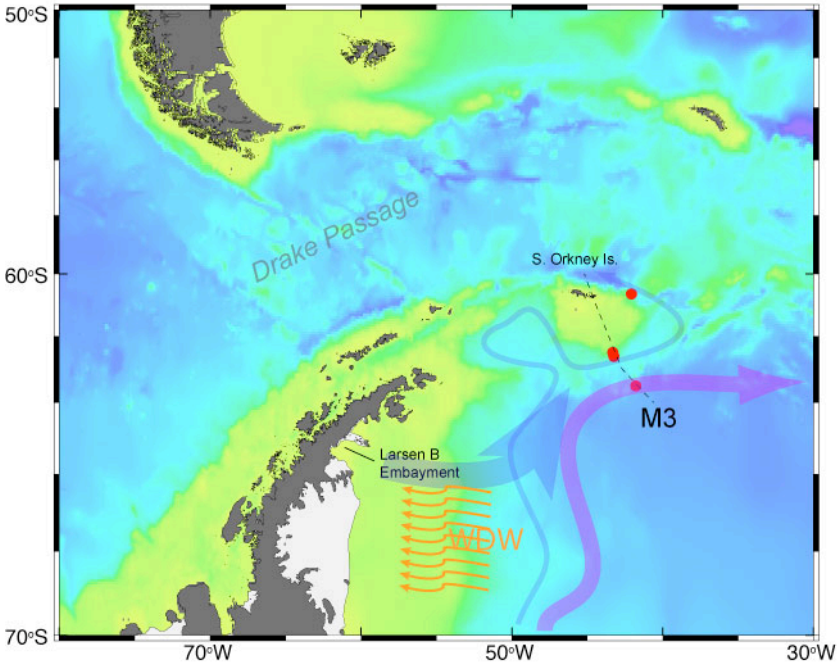

Figure 1. Location of the Weddell Sea moorings (red dots) and repeat CTD/Tracer line (dashed line). Shown schematically are the pathways of deep and bottom waters formed by interaction of WDW with continental and ice shelf waters.

First installed in April 1999, the moorings are serviced using ship time made available by other programs, primarily through the National Science Foundation Office of Polar Programs (OPP), and principal investigators funded by OPP who graciously allow our team to sail on their cruises.

As time and resources allow during the mooring maintenance cruises, oceanographic stations to collect profiles of conductivity, temperature and tracers (CTD/tracer) are occupied at the mooring sites and at stations distributed along a line between the mooring locations (Figure 1). The cost of ship time devoted to the mooring work and associated CTD/tracer stations, typically 3 to 5 days, has been supported by funding from OCO.

Accomplishments

We have established a cooperative arrangement with colleagues at the British Antarctic Survey (BAS) to continue servicing the ARCHES moorings, and to expand the array in conjunction with the BAS program in the region. One member of our group joined a BAS cruise on board RRS Ernest Shackleton in February-March 2007, during which the BAS and LDEO ARCHES moorings were serviced. The newest of the ARCHES moorings, M_4, within the trough feeding Weddell water into the Scotia Sea is now part of an enhanced array of moorings in the trough, using LDEO and BAS equipment to better resolve this branch of bottom water spreading. The configuration of the joint LDEO-BAS array of moorings is shown in Figure 2. Under the cooperative arrangement, the ship time was provided at no cost to OCO in 2007.

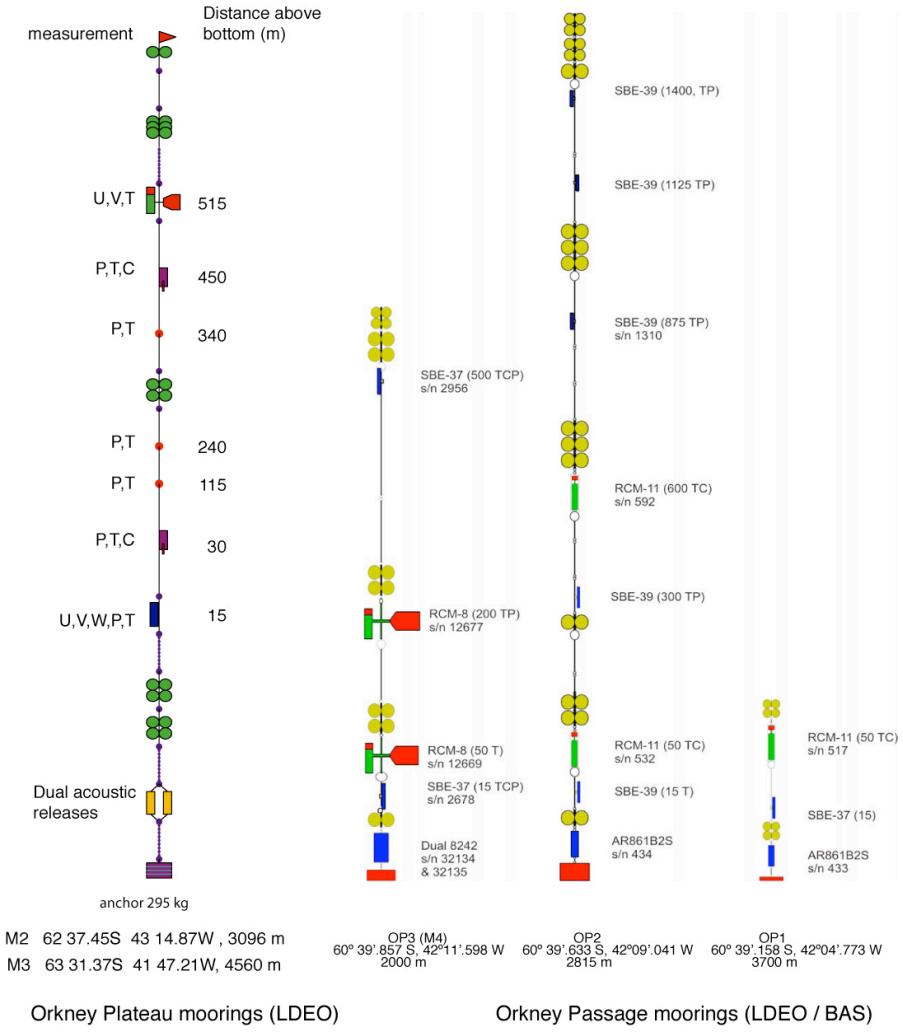

Figure 2. Weddell moorings - configurations and locations.

Recovery of mooring M_3 has extended the deep time series to nearly 8 years (Figure 3).

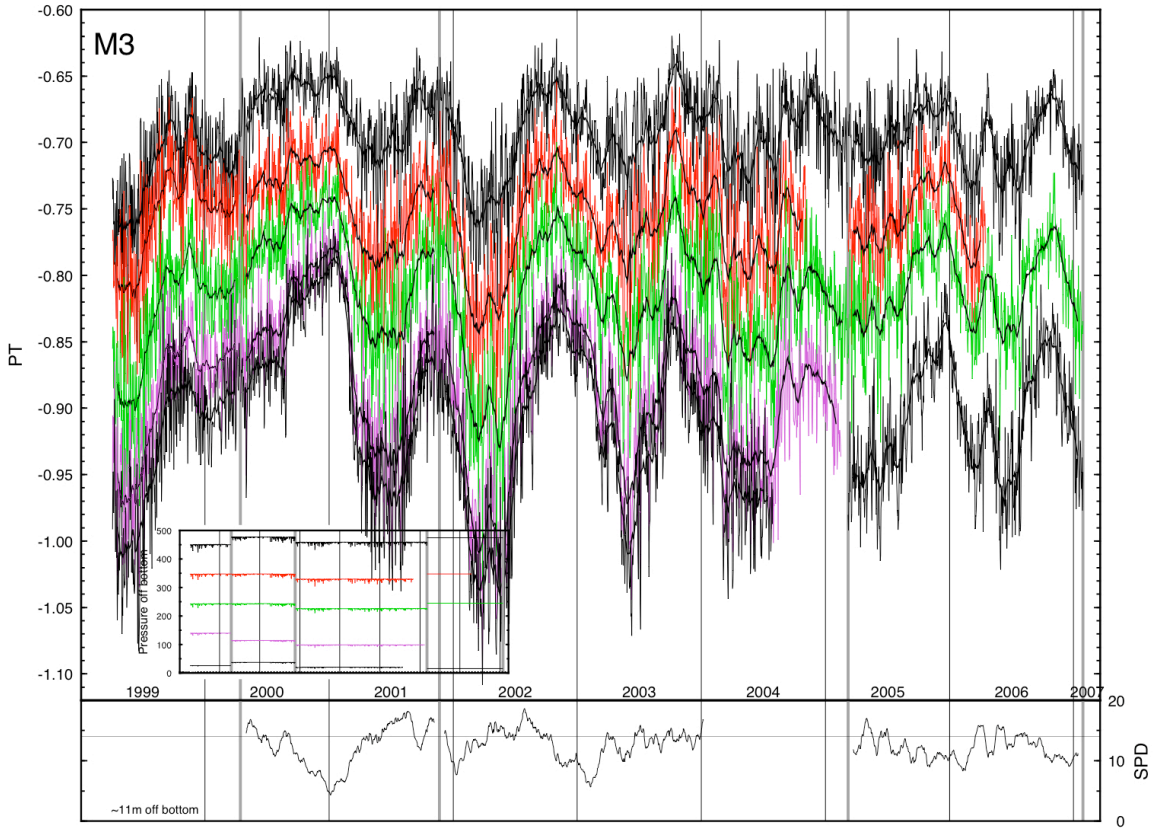

Figure 3. Potential temperature and speed at mooring site M_3

Publications

Meredith M. P., A. Naveira Garabato, A. L. Gordon, and G. C. Johnson (submitted), Evolution of the deep and bottom waters of the Scotia Sea, Southern Ocean, during 1995-2005, *Journal of Climate*.